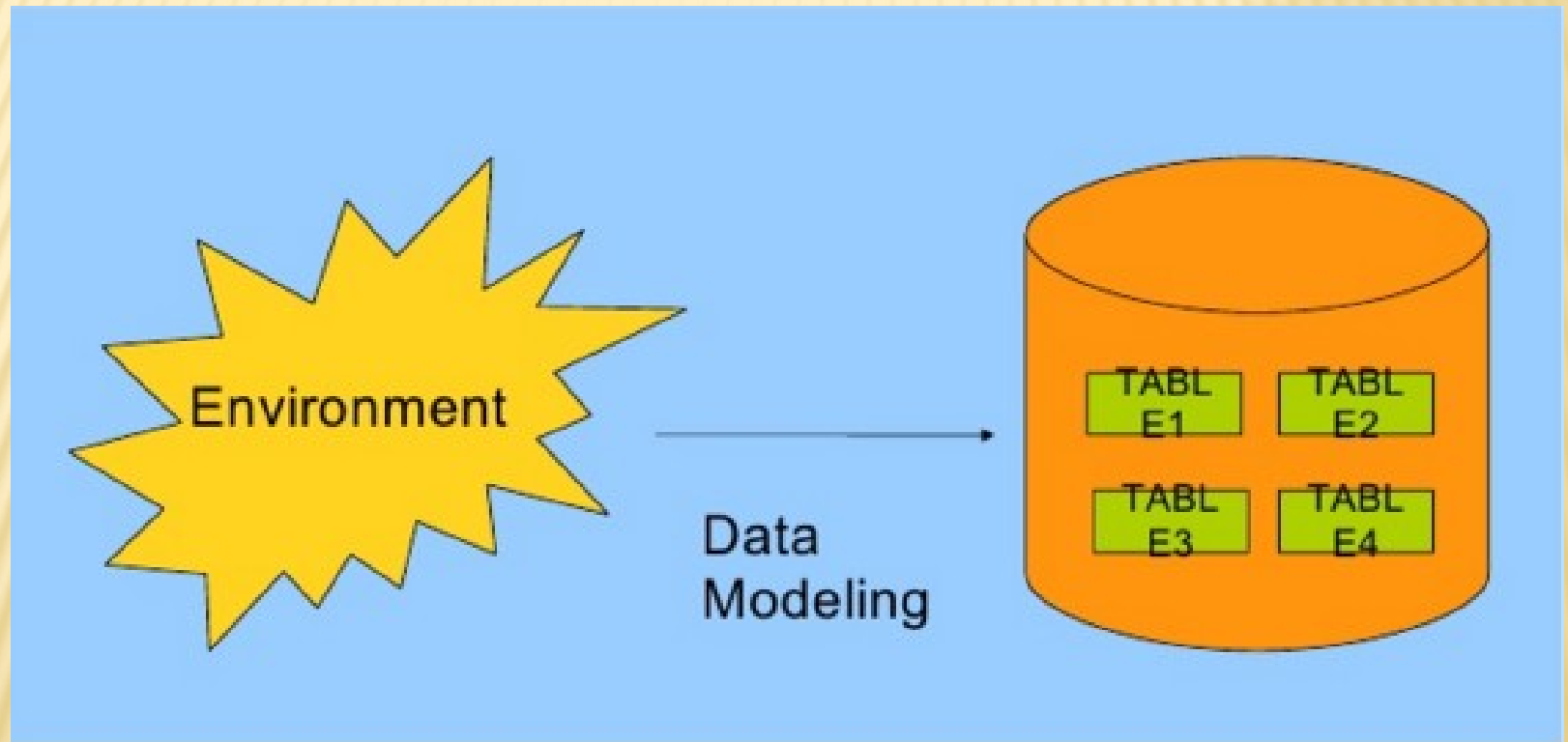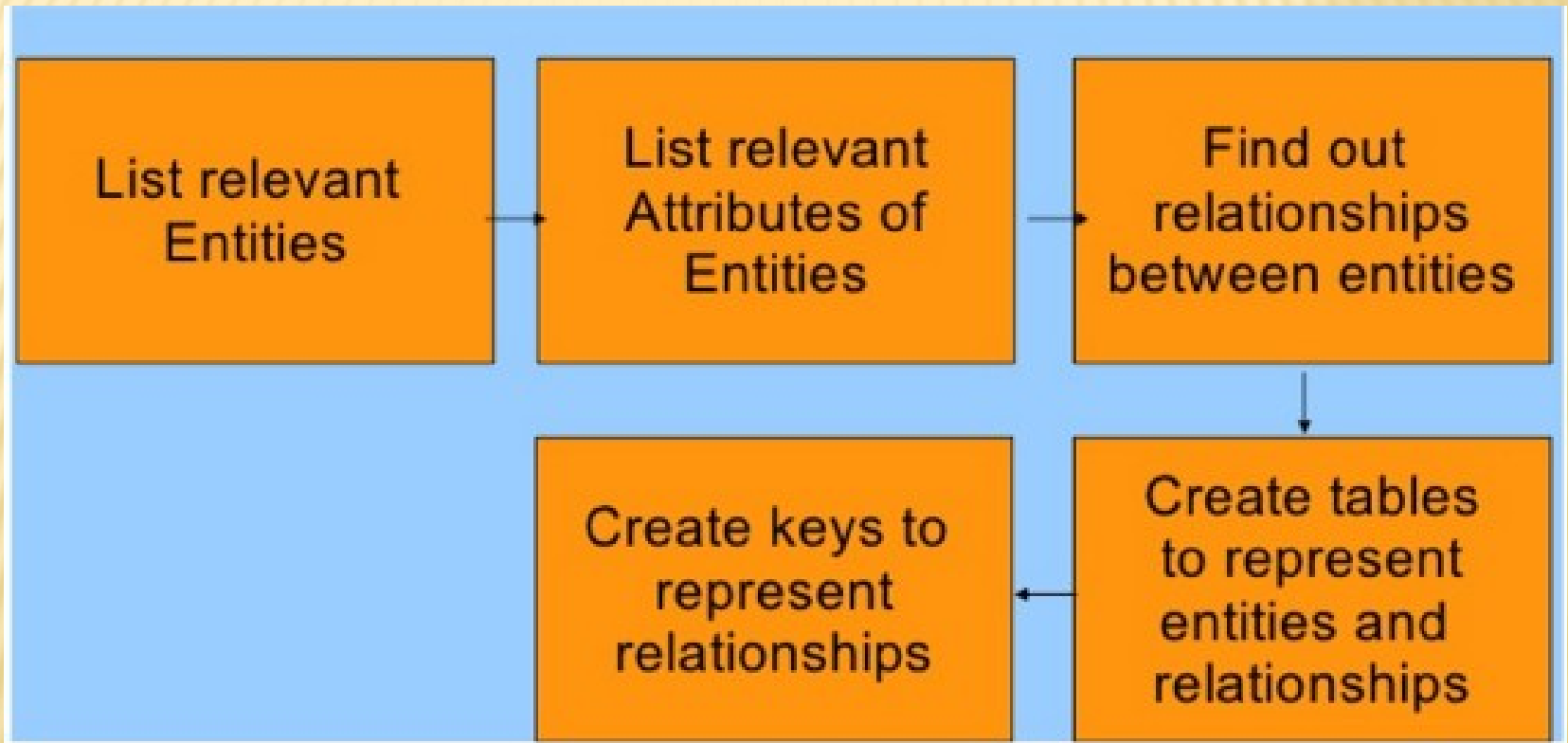# DATA MODELLING
DATABASE MODELS

DATA MODELING

Process of exploring what kind of data needs to be stored and then creating data structures accordingly

DATA MODELING

DATA MODELING

DATA MODELLING

" Data modeling involves understanding a business problem and analyzing the data and information needed to deliver a solution."

- The data modeling done at the level of the entire enterprise is called **Enterprise Data Modeling**.

- It starts investigation from general data to departmental level.

DATA MODELING

- Key considerations while designing DB
  - what data to collect
  - what the source of the data will be
  - who will have access to it
  - how one might want to use it
  - how to monitor database
  - performance in terms of response time, availability, and other factors.
- To show some logical relationships among data, we use data model.

DATA MODEL

- Relatively simple representations, usually graphical, of complex real-world data structures
- Facilitate interaction among the designer, the applications programmer, and the end user
- End-users have different views and needs for data
- Data model organizes data for various users

DATA MODEL BASIC BUILDING BLOCKS

- Entity - anything about which data are to be collected and stored
- Attribute - a characteristic of an entity
- Relationship - describes an association among entities
    - One-to-many (1:M) relationship
    - Many-to-many (M:N or M:M) relationship
    - One-to-one (1:1) relationship

TYPES OF DATA MODELS

- Hierarchical
- Network
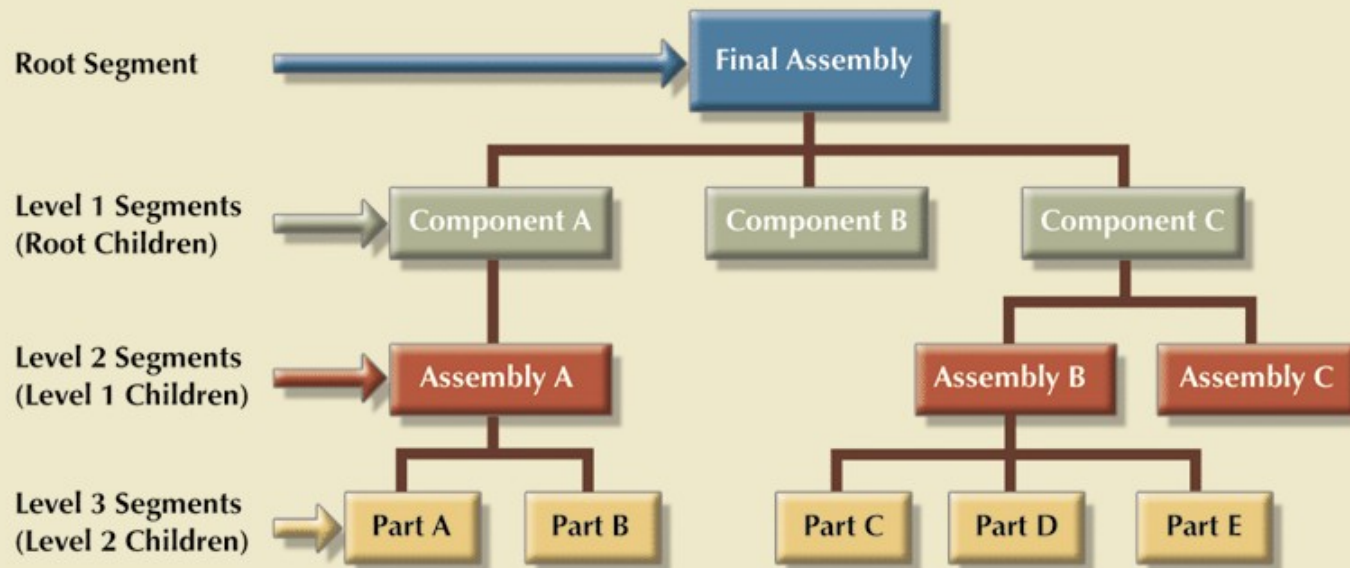- Relational
- Entity relationship

HIERARCHICAL DATA MODEL

- Developed in the 1960s to manage large amounts of data for complex manufacturing projects

- Basic logical structure is represented by an upside-down "tree"

HIERARCHICAL DATA MODEL

FIGURE 2.1   A hierarchical structure

HIERARCHICAL DATA MODEL

- The hierarchical structure contains levels, or segments

- Depicts a set of one-to-many (1:M) relationships between a parent and its children segments
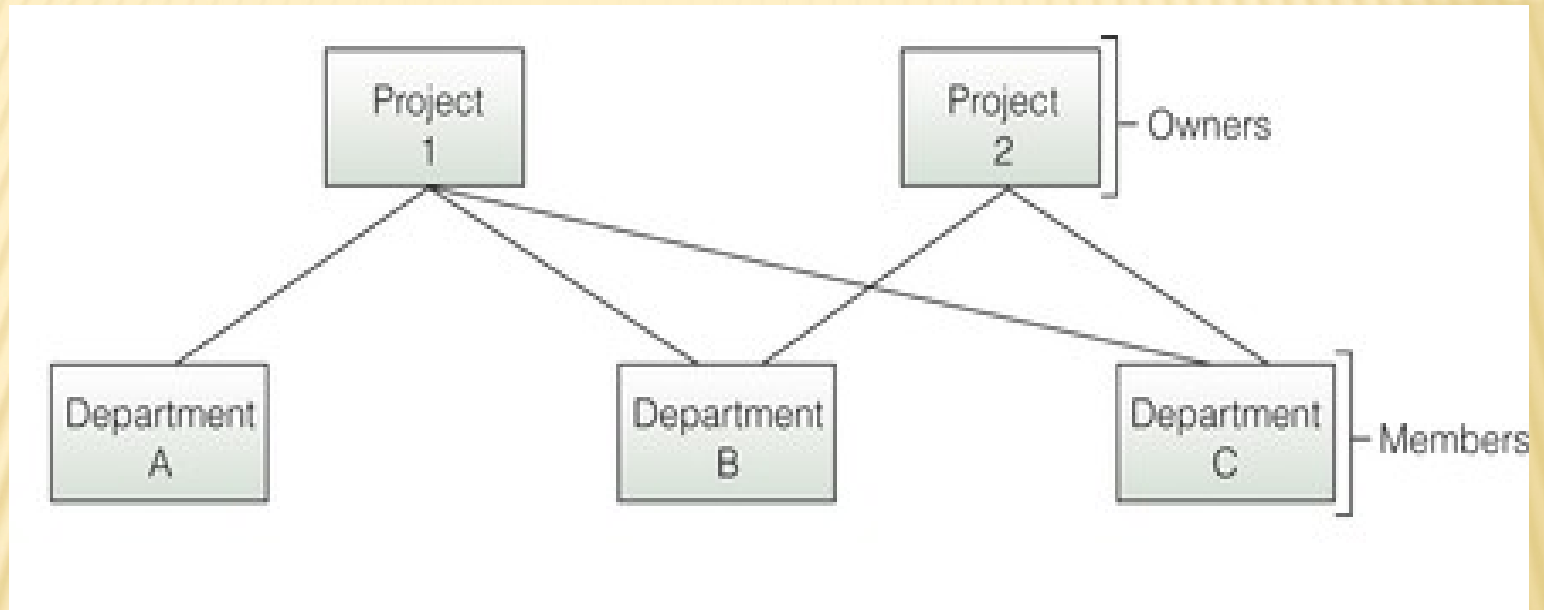 - Each parent can have many children
  - each child has only one parent

NETWORK DATA MODEL:

- It is similar to hierarchical model.
- In it , child node can have more than one parent nodes.
- It is flexible than hierarchical model.

NETWORK DATABASE MODEL

RELATIONAL MODELS

"A database model that describe data using a standard tabular format with all data elements placed in two-dimensional tables, called relations, that are the logical equivalent of files."

- Each row represents data entity.

- Each columns represents attributes.

- The allowable values for data attributes is called **domain.**

- For example negative values for pay rate is not allowed.

- It is more flexible than other models

RELATIONAL MODELS

- It allows data manipulation which includes
  - **Selecting:-**
    - Means eliminates rows according to certain criteria.
  - **Projecting:-**
    - Means eliminates the column in a table.
  - **Joining:-**
    - Means joins two or more tables.
  - **Linking:-**
    - Means links two or more tables using common data attributes.

RELATIONAL DATABASE MODEL

Data table 1: Project table

Project number	Description	Dept. number
155	Payroll	257
498	Widgets	632
226	Sales Manual	598

Data table 2: Department table

Dept. number	Dept. name	Manager SSN
257	Accounting	005-10-6321
632	Manufacturing	549-77-1001
598	Marketing	098-40-1370

Data table 3: Manager table

SSN	Last name	First name	Hire date	Dept. number
005-10-6321	Johns	Francine	10-07-1997	257
549-77-1001	Buckley	Bill	02-17-1979	632
098-40-1370	Fiske	Steven	01-05-1985	598

ENTITY RELATIONSHIP MODEL

- Widely accepted and adapted **graphical tool** for data modeling
- Introduced by Chen in 1976
- Graphical representation of entities and their relationships in a database structure

ENTITY RELATIONSHIP MODEL

- Entity relationship diagram (ERD)
  - Uses graphic representations to model database components
  - Entity is mapped to a relational table
- Entity instance (or occurrence) is row in table
- Entity set is collection of like entities
- Connectivity labels types of relationships
  - Diamond connected to related entities through a relationship line

ENTITY RELATIONSHIP MODEL

FIGURE 2.5 The basic Chen ERD

A One-to-Many (1:M) Relationship: a PAINTER can paint many PAINTINGs; each PAINTING is painted by one PAINTER.

PAINTER — 1 — paints — M — PAINTING

A Many-to-Many (M:N) Relationship: an EMPLOYEE can learn many SKILLs; each SKILL can be learned by many EMPLOYEEs.

EMPLOYEE — M — learns — N — SKILL

A One-to-One (1:1) Relationship: an EMPLOYEE manages one STORE; each STORE is managed by one EMPLOYEE.

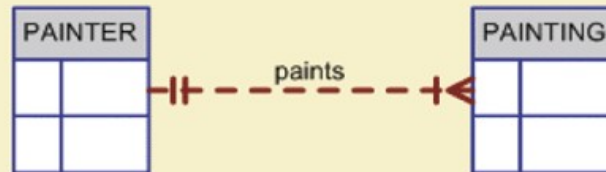EMPLOYEE — 1 — manages — 1 — STORE
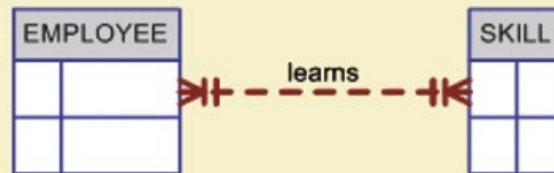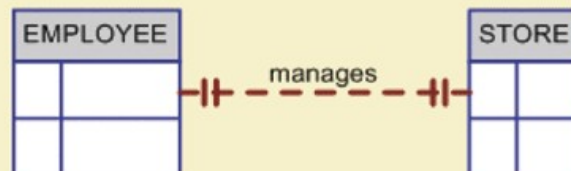
ENTITY RELATIONSHIP MODEL

FIGURE 2.6   The basic Crow's foot ERD

A One-to-Many (1:M) Relationship: a PAINTER can paint many PAINTINGs;
each PAINTING is painted by one PAINTER.

PAINTER — paints — PAINTING

A Many-to-Many (M:N) Relationship: an EMPLOYEE can learn many SKILLs;
each SKILL can be learned by many EMPLOYEEs.

EMPLOYEE — learns — SKILL

A One-to-One (1:1) Relationship: an EMPLOYEE manages one STORE;
each STORE is managed by one EMPLOYEE.
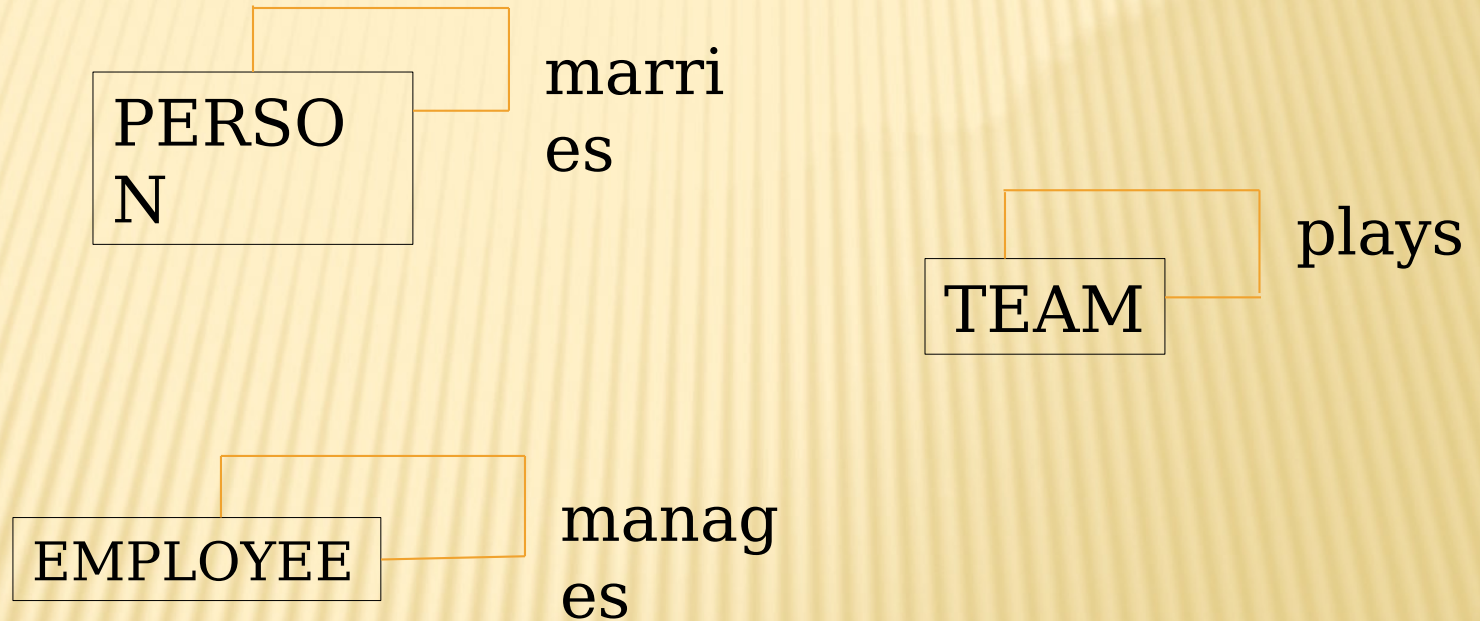
EMPLOYEE — manages — STORE

DEGREE OF A RELATIONSHIP

- Degree
  - The number of entity types that participate in the relationship.
- Unary
  - A relationship between the instances of a single entity type.
  - Example
    - Person marries Person
    - Employee manages Employee
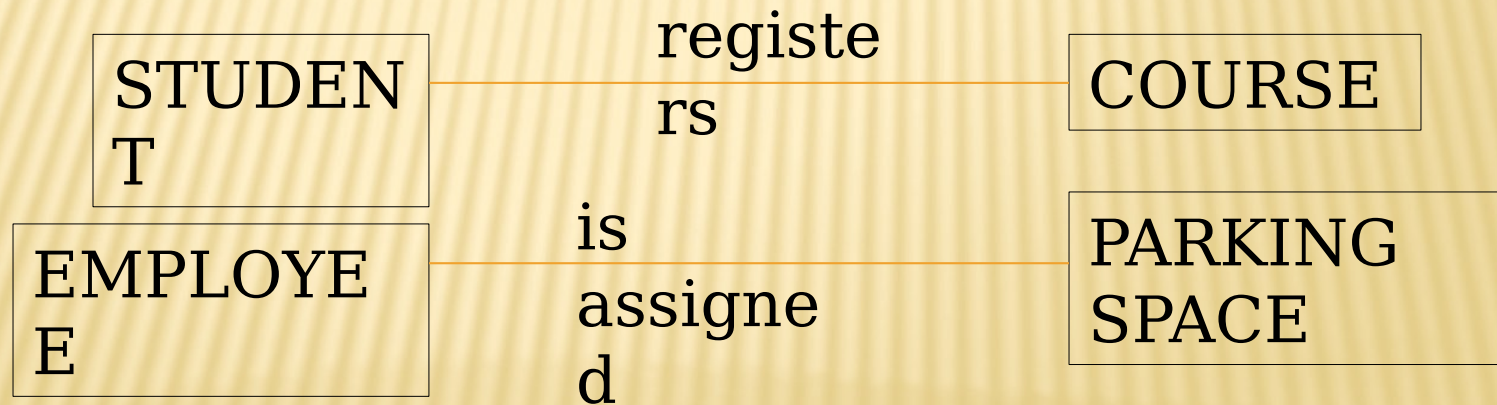   - Team plays with Team

UNARY (ONE TO ONE) RELATIONSHIP
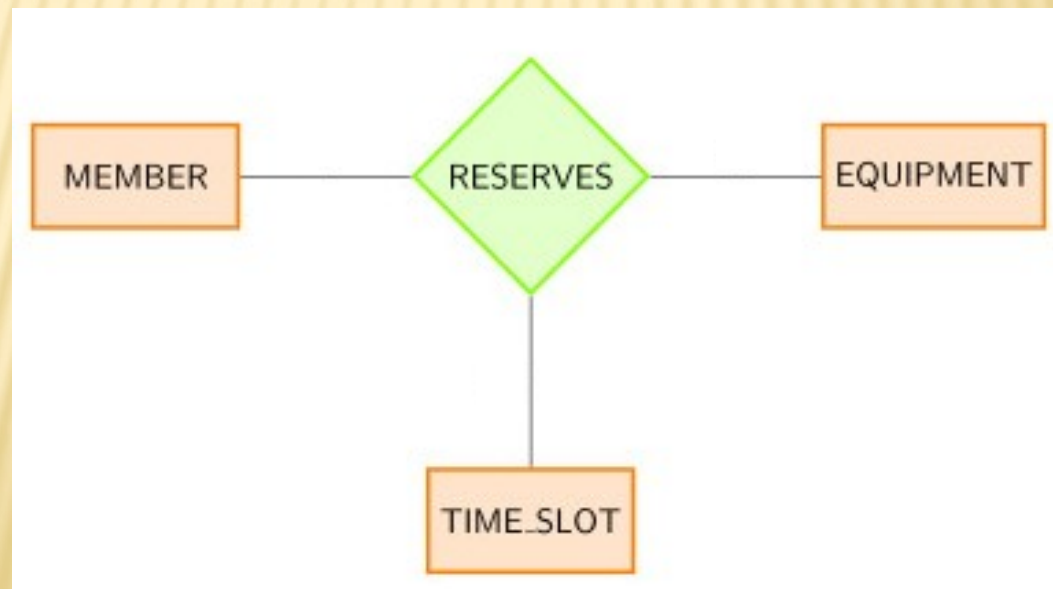
PERSON — marries

TEAM — plays

EMPLOYEE — manages

- A relationship between the instances of a two entity types.
- Example
  - STUDENT registers COURSE
  - Employee is assigned PARKING SPACE

STUDENT	registers	COURSE
EMPLOYEE	is assigned	PARKING SPACE

TERNARY

- A relationship among the instances of a three entity types.
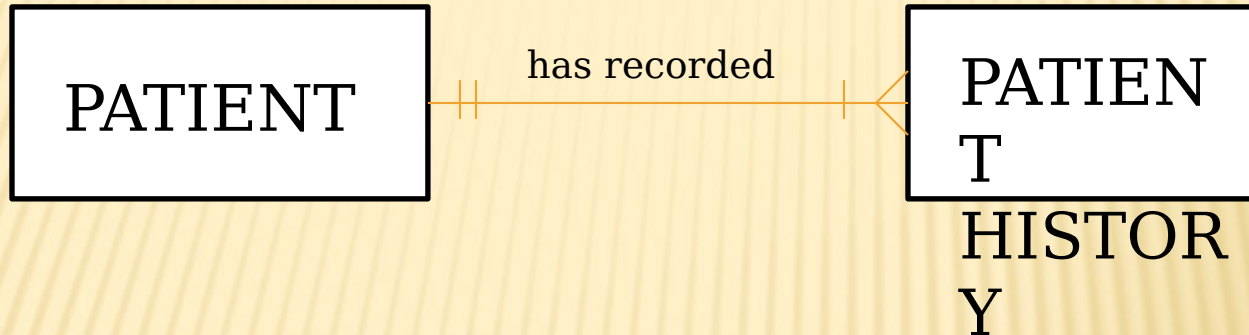 - Example
    - MEMBER reserves EQUIPMENT and TIME_SLOT

CARDINALITY CONSTRAINTS

- Cardinality constraint specifies the number of instances of one entity that can be associated with each instance of another entity.
- There are three symbols used to show cardinality
  - 0 -   A circle means zero
  - | - A line or stroke means atleast one
  - ⋗A crow foot means many

- Minimum Cardinality
  - The minimum number of instances of one entity that can be associated with each instance of another entity.

- Maximum Cardinality
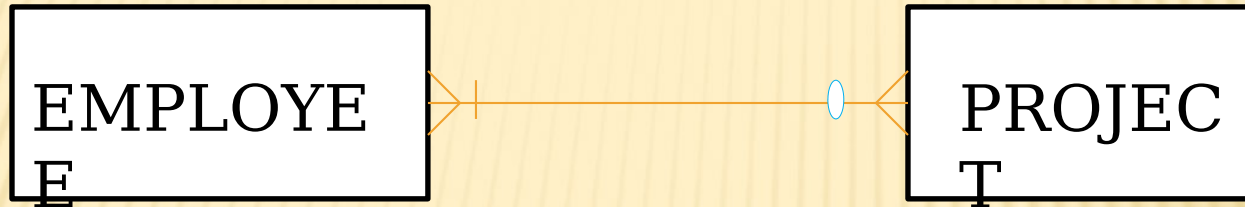 - The maximum number of instances of one entity that can be associated with each instance of another entity.

CARDINALITY - EXAMPLE

PATIENT — has recorded — PATIENT HISTORY

- Mandatory cardinalities are involved.
- Each patient has one or more patient histories. Each instance of PATIENT HISTORY belongs to exactly one PATIENT.
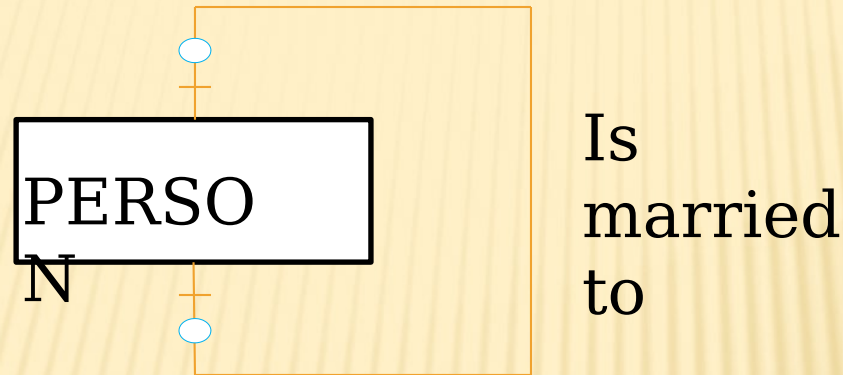
CARDINALITY - EXAMPLE

EMPLOYEE   PROJECT

- One optional and one mandatory cardinality are involved in above example.
- Each PROJECT has at least one EMPLOYEE assigned to it. Each EMPLOYEE may or may not be assigned to any existing PROJECT, or may be assigned to one or more PROJECTs.

CARDINALITY - EXAMPLE

PERSON

Is married to

- One optional cardinality is involved in above example
- This is an optional zero or one cardinality in both directions, because a person may or may not be married.